The research on adaptation equalization by the CMA Adaptive Array Antenna in a wireless home network

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In recent years, the spread of the radio devices represented by the wireless LAN of IEEE802.11b conformity etc. is remarkable, and it is not an exception in a home network field. It can predict that various problems arise with the spread of these radio devices, and an electric wave interference problem is mentioned as an important problem also in it. For example, also in communication between Laptop-PC and a wireless LAN station, the electric wave which comes directly, and the electric wave reflected in a surrounding thing, a surrounding wall, etc. are received simultaneously. In such a case, the electric waves which received interfere with each other, it suits and the situation which cannot reproduce the received data correctly may happen.

Generally, in radio transmission, the delay wave (interference wave) which spreads a different transmission way in addition to the wave of choice, and arrives exists, and multipath interference arises. Multipath interference causes frequency selective fading, and causes degradation of a received signal. It was called the video and the sound as high-speed wireless LAN etc. spread further and the radio home network became general, it can expect easily that data communication of a large zone is required. In such an environment, the interference by the multipath degrades a signal and poses a problem which cannot be disregarded since visual problems, such

as a ghost, are also caused. In order to suppress such interference, various modulation systems in a next-generation radio device, such as spectrum diffusion, OFDM(Orthogonal Frequency Division Multiplexing), and MC-CDMA(Multi Carrier - Code Division Multiple Access), are examined.

In this research, since it is adopted as the high-speed wireless LAN based on the IEEE802.11a standard or the IEEE802.11g standard, the land-based digital broadcasting by which test broadcast is started soon, its attention is paid to an OFDM transmission system. Although the OFDM transmission system is equipped with the measure against delay wave interference by multi-career modulation or the guard interval, there is no measure to interference exceeding a guard interval. If the signal exceeding a guard interval comes as a delay wave, the orthogonal nature between subcarriers will collapse and a great error will be produced to a received signal. Becoming a fatal problem in transmission of extensive zone data in the future is expected. Then, by this research, by using a CMA(Constant Modulus Algorithm) Adaptive Array Antenna together to an OFDM transmission system, the weak point of an OFDM transmission system is conquered and a characteristic improvement is tried.

An adaptive array antenna is the technology of preparing two or more antenna elements, operating the beam of a profit in software by compounding the signal received with each antenna after suitable dignity attachment, and removing an unnecessary signal. Usually, the information on the signal of choice called reference signal is required for weight control performed by the adaptive array. With such control algorithm, it is indispensable that the synchronization with a signal and a reference signal to catch can be taken. Therefore, it is weak to timing jitter. Then, in this research, such a problem is coped with by adopting CMA. With CMA, since only the prior knowledge "envelope curve of the signal of choice is fixed" is required, the synchronization with a reference signal is not needed. Therefore, since the processing which does not produce the problem of timing, either and continues taking a synchronization is not needed, either, the composition and mounting of a system become easy.

However, there is a problem that the OFDM signal does not fulfill the conditions of CMA in applying a CMA Adaptive Array to an OFDM transmission system. That is, since OFDM modulation are multi-career modula-

tion, they do not fulfill the conditions "envelope curve of the signal is fixed". Then, in this research, the technique of applying CMA to the OFDM signal which is not constant envelope curve was proposed. In this research, it tries to operate CMA by two kinds of approaches. The first approach is the method of operating CMA by inserting the FSK(Frequency Shift Keying) signal which had constant envelope curve nature in the transmitting symbol of OFDM. Moreover, the second approach is the method of controlling by the signal insertion type without using a control signal, since degradation of transmission efficiency is expected. If it says concretely, using CMA showing good operation to QAM(Quadrature Amplitude Modulation) signals, a CMA Adaptive Array is operated after FFT at the time of an OFDM recovery. Therefore, it is an effective method when the modulation system of a subcarrier is QAM. And the case where the modulation system of a subcarrier is QPSK is also discussed. By this technique it becomes controllable which it is not accompanied by the control signal. In this paper, the detailed design was carried out about the first approach, characteristic evaluation by the computer simulation was performed, and only examination on a design was performed about the second approach.

In this paper, the control technique of a CMA Adaptive Array applicable with an OFDM transmission system was proposed, and estimated the improvement of the characteristic by performing the computer simulation by MATLAB. In characteristic evaluation of the CMA Adaptive Array using the array control signal, although it was dependent on environmental parameters, such as a rate of amplitude attenuation, and an arrival angle difference of an arrival wave, the improvement of a maximum of about 150% was found. As a problem, degradation of the transmission efficiency by inserting a control signal and a possibility of breaking down the orthogonal nature of an OFDM signal at the time of arrival of the signal accompanied by great delay time etc. is mentioned, and there is room of an improvement about these problems. Moreover, in order to solve these problems, the controlling method without the control signal which was being mentioned as the second approach was examined.